State of California **The Resources Agency of California**

M e m o r a n d u m

To: JOHN L. GEESMAN, Chair
JAMES D. BOYD, Associate Member
2005 IEPR Committee

Date : August 26, 2005

Telephone: CALNET (916) 654-3933

From : **California Energy Commission**
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: **STAFF'S RESPONSES TO COMMENTS ON THE REPORT:** ***Issues and Environmental Impacts Associated with Once-through Cooling at California's Coastal Power Plants*** (O4-IEP-1A)

Staff received three comment letters in response to the once-through cooling white paper: *Issues and Environmental Impacts Associated with Once-through Cooling at California's Coastal Power Plants,* which was discussed at the Environmental Performance Report workshop on June 28, 2005. The three letters came from owners of coastal power plants that use once-through cooling (AES, Reliant, and West Coast Power). Staff's responses to the comments are attached.

Common themes in the comments included concerns about staff's assessment of the adequacy of past impact studies that have or have not been done at each coastal power plant and the appropriateness of staff's proposed policy recommendations. Additional comments were also provided regarding the value of old data, staff's 100 percent mortality assumption, the use of the habitat production foregone approach in determining impacts, and the assertion that staff is silent on the new federal regulations.

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TERRENCE O'BRIEN, Deputy Director
Systems Assessment and Facilities Siting Division

Attachment

Energy Commission Staff Responses to Comments Received on the Staff White Paper "Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants" (04-IEP-1A)

(August 26, 2005)

The California Energy Commission held a workshop on June 27 and 28, 2005 as part of the Integrated Energy Policy Report process to receive comments on the Staff Report: 2005 Environmental Performance Report of California's Electrical Generation System and supporting white papers. Following are Energy Commission staff responses to written comments provided by AES Southland LLC, Reliant Energy and West Coast Power following the workshop on the white paper: "Issues and Environmental Impacts Associated with Once-Through Cooling at California's Coastal Power Plants". Staff has excerpted the exact language from the written comments to provide as direct information as possible. Responses to comments are numbered, and in the case of repeated comments, staff responses refer the reader to the response number that contains a full response to the comment. Staff has responded only to those comments that require clarification or new information.

These Responses to Comments are directed to Commissioners Geesman and Boyd, the Presiding and Associate Members, respectively, of the 2005 Integrated Energy Policy Report (Energy Report) Committee. It is anticipated that these responses will help in the final drafting of the Energy Report, both in terms of summarizing the staff report and considering recommendations for future actions.

§316(b) Framework

AES-1

"While we disagree with the Staff Report that entrainment and impingement studies at AES Alamitos and AES Redondo Beach are inadequate, new studies are scheduled to begin in January 2006."

Response: Appendix 1 of the white paper does not state that entrainment and impingement studies at these power plants are inadequate (see Appendix 1, Summary Table). Specific problems with the entrainment studies that make their accuracy "unknown" are stated in the sections of Appendix 1 that review studies at Alamitos and Redondo Beach. While AES can "disagree," staff cannot substantively respond unless specific reasons for disagreement are given.

CEC Permitting Policy

AES-2

"The report recommends the CEC adopt a policy such that future projects at coastal facilities using once-through cooling systems could only be permitted where alternative technologies are both environmentally undesirable and economically unsound. This policy effectively discourages

modernization projects at coastal facilities that would otherwise replace older generating units with newer, more efficient ones."

Response: The intent of the Energy Commission staff policy proposal is to discourage the use of once-through cooling. While there are clear benefits from repowering coastal power plants using once-through cooling, there are also adverse environmental effects in the form of perpetuating impacts to aquatic ecosystems. Business decisions on whether to proceed with modernization projects are a function of many market and financial factors; the incremental cost differences in cooling technologies should not be a significant element in the business and engineering calculus.

As shown on Figure 3-4 in the 2005 Electricity Environmental Performance Report, California's fleet of retrofit steam boilers operate at low capacity factors that range from 10 percent to 20 percent. The business decisions on retirement or repowering are driven by the ability of the plant owners to secure contracts for capacity and energy; environmental compliance requirements do not appear to be determinative.

The incremental cost differences between cooling technologies for repowering coastal facilities are modest in the context of total capital costs. For example, data from the Morro Bay Final Staff Analysis are that for a $650 million 1,200 MW facility, upgrading the once-through cooling system would cost $9.9 million, while switching to dry cooling would cost $61.8 million (Morro Bay FSA, Part 3, Appendix A to Biological Resources, Tables 3 and 4). For the Potrero Unit 7 power plant project (540 MW), dry cooling was estimated at $35 million, while upgrades to the once-through cooling system were estimated at $25 million (cited in staff once-through cooling report). Total capital costs were estimated to range from $260 million to $320 million. A recent paper presented at the Advanced Cooling Strategies/Technologies Conference summarized that dry cooling systems range from $21 to $26 million for a 500 MW combined cycle plant, with wet cooling towers ranging from $5.7 to $6.5 million (Maulbetsch and Zammit 2005).

All the green field power plant projects constructed in California use either wet cooling towers or dry cooling. The business decision to construct is a function of many financial and market factors, and cooling system cost considerations are unlikely to be a primary determinant.

Adequacy of Existing 316(a) and 316(b) Data

AES-3

"The Staff Report implies that entrainment data for the Alamitos and Redondo Beach facilities are either non-existent or inaccurate (Table 1). Entrainment studies were done with over sight from the Los Angeles RWQCB, the National Marine Fisheries Service, and the California Department of Fish and Game, and were done in conformance with published EPA guidelines."

Response: Chapters 3 and 4 of the staff report discuss the failure of the current NPDES permit review and renewal program as practiced by many Regional Water Quality Control Boards in California. That is why closer coordination and cooperation among the agencies responsible for assessing the impacts of power plants that use once-through cooling, and evaluation of impacts assessment designs, analyses and interpretation of results by non-agency experts, are recommended. Staff from the Department of Fish and Game, NOAA Fisheries, State Water Resources Control Board and California Coastal Commission all provided public comment in support of the Energy Commission staff report.

Appendix 1 of the report was widely circulated for review, and many industry representatives made similar comments. These comments and responses are provided in Appendix 2 of the report. See, for example, response to Comment 3 in Appendix 2: "That regulatory protocols and report reviews were developed and done by regulatory agencies does not necessarily mean that the protocols resulted in accurate and comprehensive impact determinations."

Inaccurate Entrainment Impact/Mitigation Estimates

AES-4

"We also disagree that thermal impacts from the Alamitos and Redondo Beach Generating Stations were not completely assessed."

Response: The reasons for the conclusions of "incomplete assessment" are given in the sections on these power plants in Appendix 1 of the report. Similar to Comment 1 above, staff cannot respond further to this comment without knowledge of the specific reasons for the AES disagreement.

Standardization of Impact Studies

AES-5

"The Staff Report is inaccurate in suggesting there has been mitigation for entrainment impacts at the Huntington Beach Generating Station."

Response: The report does not suggest there has been such mitigation. The mitigation listed in Table 1 for Huntington Beach Generating Station is listed as a "preliminary mitigation estimate" (see Table 1, Footnote B).

AES-6

"As previously stated, there has been no required mitigation for entrainment impacts at Huntington Beach. Even so, the production foregone estimates in Table 1 are highly inaccurate. The CEC Staff estimates are wrong, and are further applied to incorrectly estimate cumulative habitat production foregone (not habitat loss, as stated in the report) for all southern California coastal generating stations."

Response: The portion of the comment about required mitigation is discussed in the response to Comment 5, above. The estimate in Table 1, as indicated in Footnote B of the Table, was a preliminary estimate from P. Raimondi (member of the Energy Commission's technical review group for the recent entrainment and impingement study for the Huntington Beach Generating Station) based on information in the draft entrainment study report. Staff's evaluation of the issue of entrainment impacts at the Huntington Beach power plant is not yet complete.

AES-7

"While a standardization of impact studies in California might make it easier for CEC Staff to determine cumulative impacts, the variety of cooling water intake systems, affected environments, and regulatory compliance requirements suggests that not all studies should be designed the same."

Response: The Staff understands that the cooling systems and environments vary among coastal power plants. The report did not mean to imply that "all studies should be designed the same," but that the overall approach and methods should be similar so that the results are as accurate as reasonably possible, that similar measures of impact are used, and that the results can be compared among plants.

Reliant-1

"The report is critical of previous studies of fish impingement and entrainment in once-through cooling systems because studies were conducted some time ago, did not use assessment methods available today or were not standardized. The report does not adequately recognize the level of assessment that is required by EPA's Phase II 316(b) regulations that California's coastal power plants are currently addressing. These regulations will require a thorough, state-of-the-art assessment of impingement and entrainment impacts and establish impact reduction levels."

Response: Appendix A reviews the studies used to assess impacts at all 21 coastal power plants in California using once-through cooling. The purpose of this report was to review the adequacy of existing studies to accurately determine the effects of this use of seawater on the marine environment. Thirteen of the studies provide conclusions of unknown accuracy, meaning that they do not provide meaningful information on environmental impacts to regulators or decision-makers. Six plants have studies conducted since 1995 "using currently accepted methods [that] provide a reasonable understanding of impacts." Table 1 of the staff report summarizes the Appendix A findings.

Energy Commission staff is hopeful that the level of assessment to be required by California regulators in conformance with the new EPA Phase II 316(b) rule will be commensurate with the benchmark standards used in the studies that have provided "a reasonable understanding of impacts."

Reliant-2

"The staff report's broad generalization of inadequate studies and excessive environmental harm at all once-through systems is not justified."

Response: As reported in the staff report, there were many problems with early entrainment and impingement studies. Serious study design limitations led to evaluations that were often "inconsistent and incomplete, making quantification of impacts difficult in many cases". Since the fundamental purpose of these studies was to accurately describe these impacts, staff concluded the studies were inadequate.

The staff report clearly documents the environmental harm from power plants for which sufficient data and analysis are available. The report reasonably extrapolates these findings to statements of concern over widespread impacts from the rest of the power generation facilities using once-through cooling technology. This is especially true given current concerns about ocean ecosystem degradation, as expressed by the recent state and federal reports on the state of the oceans. Energy Commission staff recognize that impacts will vary based on the ecosystem type (sandy bottom, rocky shore, estuarine, etc.) and based on the level of degradation from other environmental stressors (industrial discharges, non-point source run-

off, storm water discharges, over-fishing, etc.). This is why appropriately designed impact studies are needed at each power plant in California using once-through cooling.

Reliant-3

“Furthermore, the fact that a set of data was collected some time in the past or was applied using earlier methods does not automatically render the data inaccurate or void of value or applicability. The data needs to be considered in the context of its use. Such data may be useful in establishing trends.”

Response: As discussed in general and in detail for particular power plants in Appendix 1 of the report, much of the "data collected some time in the past" is simply not useful for determining impacts or trends. It is well known among quantitative environmental scientists that data collected for use in determining impacts, if collected following inappropriate sample allocation or biased methods, are not useful for the accurate detection of impacts and can be misleading. New data may be useless or misleading for the same reasons. Some of the data collected in the past may be useful for something, but until that "something" is specified and the sampling designs used to obtain the data are evaluated, the usefulness of the data can not be determined.

The study approaches may not alter the validity, etc. of historical data that were obtained, but in many cases, they do. Furthermore, with the sometimes exception of impingement, all recent (as defined in the Introduction) studies have provided a much greater understanding of impacts. See, for example, the most recent thermal effects study done for Diablo Canyon Nuclear Power Plant, or the recent 316(b) study done for Morro Bay Power Plant.

Reliant-4

“The lack of a single agency with regulatory authority over all power plant once-through cooling systems is cited as a factor complicating the review of environmental impacts. How does this circumstance differ from that associated with any other environmental issues in California?”

Response: The difference is that the lead regulatory entities for the National Pollution Discharge Elimination System (NPDES) – the Regional Water Quality Control Boards – do not assess impacts under current 316(b) regulations in a consistent manner using consistent, state-of-the-art standards. Moreover, Energy Commission staff has been recommending a stricter standard of impact assessment than is used by most of the Regional Boards for NPDES permit renewal reviews. This is authorized by the Warren-Alquist Act and the California Environmental Quality Act. This paradigm is substantially different from the power plant air emissions regulatory programs, which tend to have assessment congruity between the permitting Air Quality Management Districts and the Energy Commission.

Reliant-5

“Habitat restoration has been shown to be a cost-effective means to mitigate impacts to coastal areas and to enhance the ecological and water quality benefits of such areas. Reliant Energy urges the Commission to continue to recognize the value of restoration in its policy development and regulatory decisions and to promote its consideration wherever appropriate.”

Response: Under the California Environmental Quality Act, avoiding and/or reducing impacts are the preferred impact mitigation. While compensatory habitat restoration can be a valuable option for mitigating impacts, the science is indeterminate as to how effectively it can compensate for the full suite of impacts associated with once-through cooling.

WCP-1

"While the OTC Report does a good job of describing the history of the evaluation of impingement and entrainment effects at the 21 coastal power plants that use once-through cooling systems, it takes an unscientific leap of faith regarding impacts to the marine environment and biological communities in the vicinity of these facilities. Specifically, the report is flawed since its conclusions and recommendations are not based on factual or complete information."

Response: The staff report clearly documents the environmental harm from power plants for which sufficient data and analysis are available, and which impacts occur. Factual and complete information from the numerous studies cited in Appendix 1 and in the report was used to develop the conclusions and recommendations. The report reasonably extrapolates these findings to statements of concern over widespread impacts from the rest of the power generation facilities using once-through cooling technology. This is especially true given current concerns about ocean ecosystem degradation, as expressed by the recent state and federal reports on the state of the oceans. Energy Commission staff recommends that additional study be conducted in order to better understand site specific impacts, cumulative impacts, and the relation between once-through cooling related impacts and broader degradation of marine and estuarine ecosystems and fisheries.

WCP-2

"Only where there has been sufficient data collection is it appropriate to reach any conclusions."

Response: It is Energy Commission staff's view that sufficient information has been obtained to conclude that once-through cooling impacts are potentially large and contributing to the decline of fisheries. The report notes that based on recent studies, power plants in and near estuaries may be eliminating the equivalent of nearly 11,000 acres of bay and estuarine habitat. Proper studies at all plants will help clarify the magnitude and extent of habitat loss and contribution to the decline of fisheries.

Environmental regulators and policy-makers must often make decisions without complete information. When the available information indicates serious potential for widespread environmental harm, action is often warranted. Energy Commission staff believe that once-through cooling impacts are in this category, and have put forth a suite of policy options for consideration by the Energy Commission.

The postulation that site specific effects correlate only to site specific impacts is simply not supported by the available science. As stated in the staff report, the near-shore marine and estuarine environments are breeding and nursery areas for large numbers of organisms that form the lower tiers of ecosystem food webs, as well as for eggs and larval stages of larger species. Therefore, site specific effects in such localized areas have the potential to produce impacts that are more widespread.

WCP-3

“Furthermore, some of the conclusions of significant impacts are drawn from assumptions and methodology that, most likely than not, would significantly over estimate impacts. For example, the assumption behind many of the entrainment studies is that there is 100% mortality of organisms that pass through the once-through cooling system. Admittedly, there are few studies that suggest there are higher survival rates through power plants, but at the same time there are few studies that indicate that 100% mortality is the right assumption. Using 100% mortality as a modeling assumption will result in conservative estimates of assumed impact that may profoundly over estimate the actual impacts.”

Response: The evidence that is available, especially on the fragility of larvae, suggests 100% mortality is a reasonable assumption. Seawater used in once-through cooling is habitat for the early life stages and young adults of coastal species. Entrainment results in the death of or injury to all these early life stages and small adults in the water that are not killed by impingement. It has been argued that many organisms survive entrainment and, therefore, entrainment impact assessment should be based on determinations of the actual number killed, not the number entrained (review in EPRI 2000). A partial review of entrainment survival studies done by power plants in California revealed that not all organisms are completely dead when they exit the discharge (see also Coutant 1970). However, as Coutant (1970) concluded, some studies did not completely duplicate passage through a complete cooling system, and most only assessed survivorship over very short time intervals in unnatural environments (usually immediate - 96 hrs in holding tanks at constant temperature).

Immediate numbers "alive," or surviving after a few days in holding tanks is not the survivorship measure of interest in determining entrainment mortality as it affects natural populations. The measure of interest is the survivorship and reproduction of entrained populations versus that of similar populations that are not entrained. This is a very important distinction because, for example, thermally shocked organisms may survive in experimental tanks, but in nature their altered behavior may result in rapid consumption by predators (Coutant 1970). Given this uncertainty and the lack of evidence indicating otherwise, 100% mortality has been assumed in recent entrainment studies in California (e.g. Tenera 2000).

WCP-4

“The Habitat Production Foregone approach does not include life history information that account for natural compensatory mechanisms that are necessary in estimating production. It is difficult to perceive a situation where there is absolutely no natural compensation for fish larvae where the processes of natural mortality are extremely high, usually greater than 99 percent. As a result, estimates of lost production using Habitat Production Foregone may be grossly overstated.”

Response: There is debate over whether or not the mortality of eggs, larvae and adults caused by entrainment and impingement results in the reduction of the size of adult populations. Populations may "compensate" for the loss of eggs and young by, for example, increased reproduction (review in Rose et al. 2001). If such compensation occurred in populations impacted by entrainment and impingement, then the impacts on adult populations would be reduced. While compensation should occur in theory, it has been difficult to demonstrate in populations in the field (Rose et al. 2001), and Nisbet et al. (1996) conclude, " Optimistic outcomes (of compensation) all appear to demand mechanisms which have not been proved in *any* marine fish *anywhere*." The USEPA (2004) reviewed compensation as it might apply to impingement and entrainment impacts and concluded that the potential for

compensation may, in conjunction with other impacts such as fishing, be compromised by once-through cooling systems. It may be that, given multiple impacts, "depensation," the opposite of compensation, may occur, greatly reducing the ability of populations to recover after their abundance has been reduced. Moreover, the recruitment of adults in estuarine and coastal marine fish and invertebrate populations is well know to be highly variable among years, and this variability can result from natural variation in larval survival. In contrast, most once-through cooling systems operate with little variation; they do not "compensate" by reducing mortality when natural larval survival may be low. High larval and spore abundances may also be critical to long term population persistence by increasing the chances of successful dispersal to suitable habitat (e.g. Reed et al. 1988). Finally, live larvae and other small life stages are fed upon by other species, and these sources of food are reduced by entrainment. For these reasons, the USEPA and the Energy Commission staff currently consider that compensation does not reduce impacts from entrainment and impingement on adult populations.

WCP-5

“The report asserts repeatedly that the majority of the facilities have not conducted recent and scientifically valid impingement and entrainment studies. The report is routinely silent on the fact that all of these facilities have been routinely subjected to agency scrutiny and public comments in the renewal of their NPDES permits, and are subject to the US EPA’s Phase II 316(b) regulations. Therefore, staff's characterization that the facilities are doing nothing to evaluate this issue is erroneous."

Response: Staff has not so characterized. Staff has shown that much of what has been done has not been particularly useful for accurately determining impacts (see Appendix A). Staff is concerned that the same may be true of what is done in the future. Chapters 3 and 4 of the staff report discuss the problems associated with the current NPDES permit review and renewal program as practiced by many Regional Water Quality Control Boards in California. That is why staff recommends closer coordination and cooperation among the agencies responsible for assessing the impacts of power plants that use once-through ocean cooling, and evaluation of impacts assessment designs, analyses and interpretation of results by non-agency experts.

WCP-6

“The report urges the Commission to adopt a policy that would effectively ban the continued use of existing once-through cooling systems in any power plant modernization project unless an alternative form of cooling was found to be environmentally undesirable and economically unsound. . . . Such a policy may prevent or adversely affect repowering of these facilities, which account for nearly one-third of all of California’s in-state generation resources. … The consequences of not taking actions to address potential supply shortfalls due to plant retirements would expose consumers and businesses to unacceptable risks.”

Response: See response to AES-2.

WCP-7

“Staff recommendations are also counter-productive to the goals and interests of various state agencies (including the Energy Commission) and government policy that support repowering facilities

with more efficient generating units." West Coast Power cites the CPUC's December 16, 2004 Long Term Procurement Order, AB 1576 (Nunez) and the Energy Commission's 2003 Integrated Energy Policy Report as examples of such state government policies.

Response: The first two policy documents referenced by WCP are general policy statements. In the view of Energy Commission staff, the general policy recommendations on repowering do not over-ride or ignore the need for project-specific environmental assessments. Site specific evaluations of whether it is feasible and beneficial to repower an existing coastal power plant using once-through cooling should fully consider the impacts to aquatic ecosystems and biota.

In regard to the Energy Commission's own IEPR statements in 2003 and 2004, staff believes that the Commission's position on repowering encompasses the following statement on environmental quality from the 2003 IEPR:

> "California must strike a balance between delivering increasing levels of energy and its commitment to environmental quality. The challenge to policy makers will be, not just to sustain the current status of the environment, but to improve environmental quality while meeting the wide-ranging demand for energy." (2003 IEPR at 39)

WCP-8

" . . . the restrictive policy recommendations of the OTC Report would unreasonably delay or prevent the efficient co-location of much-needed ocean desalination facilities."

Response: See response to AES-2.